

# **Wind Energy Development on Oahu, Maui and Molokai**

## **U.S. Department of Energy Wind Working Group Meeting**

**Arthur Seki  
Hawaiian Electric Company, Inc.**

**Honolulu, Hawaii  
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## **Presentation Topics**

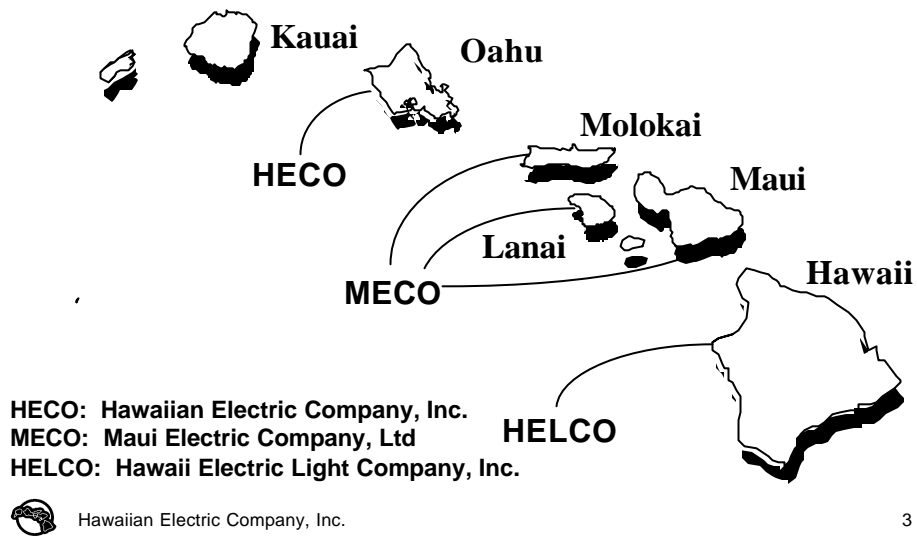
- **Electric utility background**
- **Wind development activities on various islands**
  - **Oahu**
  - **Maui**
  - **Molokai**



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## Hawaiian Electric Company Utilities



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## Characteristics of Hawaii Utilities

- Relatively small utility systems.
- No grid interconnections.
- Generation reliability is critical.

	Oahu	Big Island	Maui	Molokai	Lanai
System Capability (net), MW	1,615	253	245	12.0	10.4
Recorded System Peak (net), MW	1,191	174	191	6.5	5.2
Recorded System Minimum (net), MW	519	69	77	2.3	1.9

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## Kahuku Wind Energy Research MOD-0A Wind Turbine (1980)



- U.S. Department of Energy/NASA wind demonstration project
- HECO operated MOD-0A for 2 years
- Westinghouse 200 kW design
- Most productive of all 4 MOD-0A installations
- Capacity factor ~36 percent



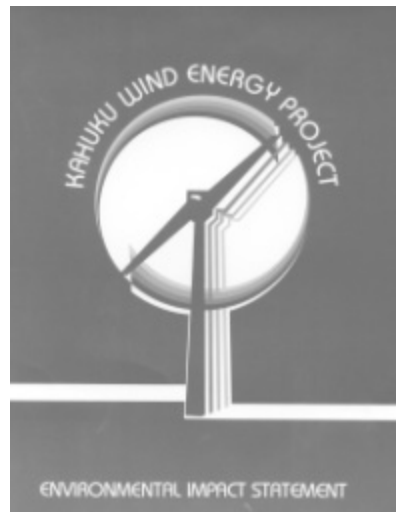
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## Kahuku Wind Farm Development Wind Farm, Ltd. (1981)



- 80 MW private wind farm development at Kahuku
- EIS prepared
- 20-4 MW wind turbines
- 138 kV line from Wahiawa to Kahuku
- Project never developed



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## Kahuku Wind Farm Westinghouse Wind Turbines (1985)



- HERS owned and operated from 1985-1993
- 15 - 600 kW Westinghouse turbines
- Production lower than projected
- Operation and maintenance was higher than projected
- Westinghouse design



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## Kahuku Wind Energy Research Boeing Mod-5B Wind Turbine (1987)



- HERS owned and operated from 1987-1993
- 3,200 kW Boeing turbine
- World's largest wind turbine
- Last of federal-sponsored turbines
- Production was lower than projected



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## Kahuku Wind Farm (1985)



- HERS owned and operated 12 MW wind farm from 1985 to 1993
- U.S. Windpower proposed a 15 MW wind farm (1991)
  - PUC approved power purchase agreement; however at lower price
  - U.S. Windpower decided not to pursue
- New World Power owned and operated from 1993 to 1996 (bankrupt)
- Reverted to landowner, Campbell Estates
- U.S. Army acquiring parcels at Kahuku for training



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## Kaena Point Wind Energy Development (1994)



- Air Force examined (1-2 MW) wind farm development
- DOD funds available for renewable energy development
- Wind turbine solicitation
- Draft EA developed for review. Issues raised related to
  - Aesthetics
  - Bird kills
  - Cultural
  - Archeological
- Air Force withdrew solicitation--recommended project not be funded



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## Maui Wind Energy Development Windane Wind Turbine (1984)



- Danish Pacific Windpower owned and operated
- MECO hosted 340 kW wind turbine demonstration
- MECO later purchased the unit (1989)
- Dismantled due to structural problems (1991)



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## Maui Wind Energy Development (1984, 2002)



- 10 MW private wind farm development in Kapalua (1984)
  - Power purchase agreement (PUC approved)
  - Problems in obtaining financing and land lease
  - Power purchase agreement terminated (1989)
- Future 20 MW private wind farm development in Kaheawa (2001)
  - EIS accepted
  - CDUP received
  - Negotiating for land lease



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## Molokai Wind Energy Development Vestas Wind Turbines (1991)



- 1 MW private wind farm development on Molokai
  - Power purchase agreement (PUC approved)
- Wind-Diesel wind farm demonstration
  - 3-100 kW Vestas wind turbines
  - 1-100 kW diesel generator
- Electronic problems due to possible lightning strike (1994)
- Power purchase agreement terminated (1997)



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## Where Will Future Wind Energy Come From?

Kauai



Oahu



Maui



Hawaii



Max. potential\* – 95 MW  
~~DOE 5% goal – 350 MW~~

Max. potential\* – 100 MW  
~~DOE 5% goal – 42 MW~~

\* Max. wind generation potential identified for Hawaii; “Renewable Energy Resource Assessment & Development Program”, Year 2000 update (DBEDT)

Maui may have excess wind resources; Oahu may be limited



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## **Interconnect Islands & Export Wind Energy**

- **Interconnecting island grid systems would allow exporting of wind energy to Oahu**
- **Interconnection studies have been performed:**
  - **Tri-Island Study (1985)**
  - **Tri-Island Cable Project (1989)**
  - **Hawaii Deep Water Cable Program (1990)**
  - **HECO Generation Siting Study (1992)**
- **Technically feasible, but economics are not attractive**



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## **Off-shore Wind Energy on Oahu**

- **Oahu is Hawaii's primary load center; however, suitable wind sites on Oahu are limited**
- **Land-intensive renewable energy projects must compete with other uses**
- **Off-shore wind energy may be an option to expand wind development for Oahu**



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## **Conclusions**

- **Goal**
  - U.S. Department of Energy “Wind Powering America”—5% wind by 2020
- **Wind incentives**
  - Federal wind production tax credit extended to the end of 2003
  - State wind tax credit available to mid-2003
- **Future development**
  - 20 MW wind farm at Kaheawa, Maui
  - Possible offshore wind development for Oahu



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